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REPORT ON PARASITES OF DOMESTICATED

ANIMALS AND MAN IN HAWAII

by

*Dr. Maurice C. Hall
Chief, Zoological Division
Bureau of Animal Industry
U.S. Dept. of Agriculture

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General Considerations

The Hawaiian Islands present a very special set-up in the way of a background for parasitism. The factors which influence parasitism operate in a miniature setting in which one can observe various factor complexes in a minimum amount of time. With a moderate amount of research one could fill in, to a large extent, the detail of the picture presented here in a general way.

The factors which influence parasitism include the presence of a parasite on the islands, the topography, the temperature, moisture, sunlight (amount and intensity), soil, flora, fauna (including intermediate hosts), farm practice, sanitation, general nutritional level of animals and man, and the economic-social level. When all of these factors are coincident at any given place in a way favorable to parasitism of any given sort, such parasitism occurs. When one essential factor is missing or several are missing, such parasitism does not occur. A consideration of some of these factors follow.

Presence of parasites. Various forms of parasites have been imported into Hawaii for a century or more. For some of these the favorable factors have clicked together and the parasite has become established at suitable places, sometimes after failing for many years to gain a foothold. For others, some factors have been unfavorable, and the parasite has not gained a foothold. Parasites are still being imported into the islands and will continue to be, since we know of no way to keep out most parasites without stopping trade. Changes of one sort and another will at some future time favor parasites not yet established. It is highly desirable, therefore, that a sentry be kept on guard, and to that end, there should be in the islands at least one competent parasitologist, preferably several such, to watch for new things and to investigate these and any already present. The tendency of all parasites is to become ubiquitous.

Topography. On all the islands there are relatively recent and steep volcanic mountains which may be central, coastal or excentric in position. Along the shore are either steep palis or relatively flat low areas. The transition between mountain and shore is often a zone of deep valleys and intervening steep ridges. Occasionally, as on Kauai, there are extensive sloping table lands separated by deep valleys, and, especially on Hawaii, some valley land widens out into fairly extensive areas. A similar wide area occurs on Oahu between the Koolau and the Waianae ranges. These topographical contours have an important bearing on the matter of rain-

*(In cooperation with the Hawaii Agr. Expt. Station. Visit made to the Territory of Hawaii, October and November, 1935.

fall as a possible producer of areas sufficiently wet to support liver flukes or forms requiring lesser amounts of water.

Temperature. In the short distance from the makai (seaward) portions of any island to the mauka (mountainward) portion, one crosses by rapid transitions from a warm tropical climate to a much cooler temperate climate. Somewhere among these transitions, on any island, there is a zone of optimum temperature for almost any given parasite, and this zone will be continuous or almost continuous. This region will be a danger zone as regards that parasite, providing other necessary favorable factors are present. The width of the zone will vary for different islands, different parasites, and, to some extent, for different seasons of the year.

Moisture. An island may present extremes of precipitation between the makai and mauka portions, and differences between windward and leeward sides. If the mountains are not too high, as in the case of the Koolau range on Oahu, there will be a maximum precipitation along these ranges and to their windward side, and the rainfall will reach 500 or 600 inches on Waialeale on Kauai and in the Kukui mountains on Maui. On Maui this falls off to a minimum precipitation at a point not far from Kihei and perhaps 3 miles in an airline from the area of maximum precipitation. Of some of these areas it may be said that they are definitely too wet for many kinds of parasites, since some parasites are, in effect, drowned by excessive amounts of moisture, although such parasites as flukes may find the set-up favorable. Of other areas it may be said that they are definitely too dry for many kinds of parasites, but in some of these areas such highly resistant forms as the horse strongyles may survive. On all these areas the utility of available rainfall for parasites is sharply conditioned by topography and soil. Heavy rainfall on the excessively steep slopes of palis (cliffs) and mountain sides has a very rapid runoff and exerts a scouring action that quickly removes parasitic material. Over a large part of the islands the soil surface is a relatively recent and little weathered lava affording little foothold or protection to parasites, and over which rainfall runs rapidly or into which it sinks rapidly.

Sunlight. Sunlight has deleterious effects of two sorts on parasite material outside of the host body. One is a drying effect and the other the lethal effect of light itself. Over the more recent lava areas and the dry areas in general, both of these factors are effective in parasite destruction. In the areas of denser vegetation there is ample shade to afford protection to parasites. What is regarded as rather little rainfall in the islands, 20 to 40 inches, would not constitute a dry area on the mainland, and over almost all the livestock area cloudiness is sufficiently prevalent to lower the sunlight intensity quite notably.

Soil. The subject of soil is treated here entirely on the basis of the writer's observations in default of other information. Much of the islands' surface is a rock formation, almost all of it igneous rock and most of this comparatively recent lava. There is a very small amount of limestone. There are large amounts of volcanic ash which constitute the material for much of the soil. Apparently the more extensive valleys have soils composed of this ash, of weathered lava, and of the humus accumulated from plant remains. Near the coast are limited amounts of sand.

In general, the recent lava areas are definitely unfavorable to parasites. They afford little or no protection from sunlight, they are subject to sharp scouring from rain, they do not support such vegetation as would lead stock to feed on them, and the porous lava would retire from circulation any parasite material lodging in its cavities. Snails which carry flukes do not appear to flourish in streams running through lava. The areas which carry growths of alga-

The first part of the paper discusses the importance of the study and the objectives of the research. It also mentions the scope of the study and the limitations. The second part of the paper discusses the methodology used in the study. It mentions the data collection methods and the analysis techniques. The third part of the paper discusses the results of the study. It mentions the findings and the conclusions. The fourth part of the paper discusses the implications of the study. It mentions the practical applications and the future research. The fifth part of the paper discusses the references. It mentions the sources used in the study.

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roba (kiawe), haole koa, and cactus are usually dry, often rocky, and the soil and the feeding habits of livestock eating these plants are unfavorable to parasitism. Over most of the islands the comparatively new and little weathered rock surface is protective against parasites.

The areas favorable for parasitism lie mostly along streams and may occur anywhere from the mauka to the makai region. They type as a few wide valleys, usually in the makai region, many narrow valleys between ridges, and relatively small swamps, pastures and swales in the mauka region. Here one finds soil which will form mud with the addition of water, a site favorable to fluke-carrying snails. The same soil is favorable to the development of the monoxenous (one-host) parasites.

Flora. The flora of the islands which has a definite bearing on the parasite problems is constantly changing by the importation of new plants, but in general the flora does not favor livestock parasitism. Such feed as algaroba, haole koa and cactus grows high and is not contaminated with manure, and parasites do not ascend such vegetation. New grasses which have been introduced are taking over the mud holes and similar areas and converting them into grassy swales over which rain flows rapidly. The taller grasses, such as elephant grass and panicum grass, defeat many kinds of parasites by their height, since parasites cannot ascend so far successfully. Fresh or shredded and cured cane tops are obviously safe feed.

Fauna. The animals that may have an unfavorable effect as regards parasitism in livestock and poultry include the wild cattle, carabao, sheep, goats and pigs, since these animals are out of control and may act as carriers and spread parasites to other animals. Such game as pheasants may bring new parasites to poultry, or perpetuate and spread other parasites of poultry.

On the other hand, frogs and such toads as Bufo marinus, destroy snails that carry liver flukes and are joined in this by ducks and various other birds.

As regards intermediate hosts, these islands have plenty of land snails, some of which would probably carry certain lungworms of livestock. Some of its aquatic snails would probably carry certain flukes, just as its amphibious snails now carry liver flukes. One fluke in the rumen of cattle and one in chickens are already present on the islands and their presence is evidence of the presence of snails that will carry them.

There are also plenty of arthropods capable of transmitting parasites. Grasshoppers probably carry the proventricular worms and sow bugs and pill bugs, which are very numerous, presumably carry another gizzard worm. Gizzard worms are known to be a pest of poultry in parts of the islands. Mosquitoes carry heartworms of dogs, and could carry other parasites if the latter were introduced. A skin disease of cattle which is present in the islands, is caused by a worm that is probably carried either by mosquitoes or hornflies, although the life history of the worm is not yet known.

Farm practice. As regards the provision of water supplies for livestock, the use of streams may be regarded as relatively safe under Hawaiian conditions, provided the streams have a rapid flow as most of the streams have in the rocky channels commonly found. This is not true for streams flowing slowly through marshes, and such streams are a source of liver fluke infestation and other infestations. It is not true of streams that carry growths of honohono grass, water cress, algae and similar vegetation. Water from a safe source supplied in drinking troughs with a float control, so that there is no overflow, is safe, but overflows often provide highly dangerous conditions. Livestock come to these

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areas, deposit manure there, and feed on the grass thereabouts, thus concentrating parasitic infestation. The wet, muddy spots are often the breeding grounds of the lymnaeid snails that carry flukes and are important sources of fluke infestation.

The two feeding practices which are definitely dangerous are the use of swamps and wet pastures for grazing, and the use of cut feed procured from such areas. Safe practices include the use of well-drained pastures, freshly cut or shredded and cured cane tops, grass cut on safe well-drained areas, algaroba, haole koa and cactus.

In chicken yards the practice of cleaning rarely or once a week gives a chance for parasites to develop and for intermediate hosts to become infected. Daily cleaning, as practiced in some places, is highly effective. Chicken yards should be kept free from trash, so that intermediate hosts of parasites cannot hide beneath them and become carriers of parasites before being eaten by chickens.

Sanitation. The usual differences between sanitation in urban and in rural areas exist in the Hawaiian islands. Honolulu is well sanitated and there is a correspondingly low incidence of human parasites. The high incident of hookworms in dogs in Honolulu is evidence that sanitation is responsible for the low incidence of hookworms in man and that conditions otherwise are favorable for hookworms. Rural areas have a much lower level of sanitation and a much higher incidence of parasitism. The incidence of parasitism in rural districts is ample evidence of soil pollution, and soil pollution is evidently widespread. Coupled with the habit of going barefoot or wearing sandals, it affords a basis for hookworm infestation.

Water cress for human consumption should be brought under regulatory control, and only cress from water that cannot be contaminated with cow, sheep or goat manure should be permitted on the market. Undoubtedly there must have been many cases of human liver-fluke infestation in Hawaii as a result of eating water cress from contaminated streams.

General nutrition. While the general nutritional level of the population of Hawaii leaves something to be desired, the level is, nevertheless, relatively high in comparison with many countries. The owners and managers of plantations and ranges have shown more than usual intelligence in providing milk and other suitable foods for their labor forces. The effect of this diet is to lessen the clinical conditions associated with parasitism, and to keep much of it at a subclinical level.

In general, livestock is well fed, although animals from some of the poorer and dryer areas show a lack of condition associated presumably with too little feed, for the most part, and unsuitable or inadequate types of feed, to some extent.

Social-economic level. The social-economic level is much higher in Hawaii than in most parts of the tropics. Employers take much better than average care of employees. The relatively small numbers of persons who own most of the islands' property show a social sense that is charged, probably correctly so, to the missionary tradition and to the limited and circumscribed area in which all the inhabitants of the islands live. The missionary tradition is perhaps most active among the women, and there are many public-spirited women in Hawaii. As a result of the circumscribed environment, wide acquaintance among employees and employers is the rule. Ownership and management go hand in hand, either in identical persons or persons closely associated and often related. There is comparative freedom from the evils of absentee landlordism.

As a result of an intelligent and friendly policy on the part of employers, the depression was mild in Hawaii. Consequently, the problems of attack on parasitism

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of any sort are simplified by the fact that there is no large relief problem to distract attention and divert funds, and by the fact that money for parasite control is available in the hands of the persons most interested in controlling parasites of man to ensure efficient labor, and parasites of livestock to protect investments in livestock.

The educational level is rising, and regardless of the problems arising from that fact, it is true that better education will lead to better sanitation. This in time will aid in parasite control. The University has done considerable educational work in connection with sanitation for poultry and livestock.

Provisions for medical care are exceptionally good in Hawaii. There is an excellent territorial Board of Health. There are many able physicians and many very good hospitals. Medical care and hospitalization are provided for plantation employees to an unusual and most commendable extent. Honolulu has a number of competent veterinarians engaged entirely in private practice, but outside of this place the field of veterinary practice and regulatory work is covered by the Territorial veterinary force, a group which has done excellent work. Technical laboratory work is handled by competent workers, but there are still too few of these in the medical set-up. Finally, there is entirely too little provision for research in either human or veterinary medicine, and the comparatively wealthy Hawaiian islands have nothing comparable to the research of the School of Tropical Medicine in Puerto Rico.

Specific Parasitisms

Parasites of poultry. Poultry in the islands suffer from several forms of parasitism, and the possible kinds and extent have not been adequately investigated. In some areas coccidiosis has been a major cause of losses. Raising poultry on wire is one way of protecting birds, but since the older birds are usually put back on the ground this method is not too happy in its results. As both Johnson and Tyzzer have noted, the more complete the protection afforded young birds, the more devastating are the results of coccidiosis among older birds when they are exposed to coccidia. The most effective control actually observed by the writer was on the island of Kauai where one poultry raiser practiced scrupulous mechanical cleaning of the poultry set-up every day, followed by liming. Presumably this practice permits the acquirement of light infections sufficient to immunize the birds against later attacks by coccidia.

Gizzard worms are recognized as a cause of injury to poultry. In two birds taken at random from a flock near Honolulu these were present in large numbers, as were two kinds of proventricular worms. Apparently the gizzard worms can be removed to a large extent by treatment, but the daily removal of the manure to tight containers where self-heating can occur, or to areas where it can be ploughed under promptly, is advisable to prevent such intermediate hosts of parasites as grasshoppers, sow bugs and pill bugs from feeding on it and so carrying back the infective stages to the birds.

Eyeworms are reported as not so plentiful as they once were. Presumably this improvement is associated with greater cleanliness and sanitation around the chicken yards. Where yards are kept free from trash and litter, any roaches that come in and are promptly eaten by chickens are just so much food. If, however, the roaches can feed on chicken droppings, and then conceal themselves in trash and escape capture for a suitable length of time, they become carriers of infective larval worms and are then dangerous to the birds that feed on them.

Cecum worms are present in birds in the islands; whether the common poultry ascarid is present was not ascertained for lack of time.

The first part of the paper is devoted to a general discussion of the problem of the origin of life. It is shown that the problem is one of the most important and interesting in the history of science. The author discusses the various theories of the origin of life, and shows that the most probable one is the theory of spontaneous generation.

The second part of the paper is devoted to a detailed discussion of the theory of spontaneous generation. It is shown that this theory is based on the fact that life is a complex phenomenon, and that it is not possible to explain the origin of life by the action of a single cause. The author discusses the various factors which are necessary for the origin of life, and shows that the most probable one is the theory of spontaneous generation.

The third part of the paper is devoted to a discussion of the evidence in favor of the theory of spontaneous generation. It is shown that there is a large amount of evidence in favor of this theory, and that it is the most probable one. The author discusses the various experiments which have been conducted in this field, and shows that the results of these experiments are in favor of the theory of spontaneous generation. The author also discusses the various objections to this theory, and shows that they are not valid.

CONCLUSIONS

The author concludes that the theory of spontaneous generation is the most probable one. It is shown that this theory is based on the fact that life is a complex phenomenon, and that it is not possible to explain the origin of life by the action of a single cause. The author discusses the various factors which are necessary for the origin of life, and shows that the most probable one is the theory of spontaneous generation. The author also discusses the various objections to this theory, and shows that they are not valid.

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Several species of tapeworms are present. The life histories of these should be ascertained in order to institute prophylactic measures. We have at present no adequate treatment for poultry tapeworms.

Parasites of dogs. Parasites of dogs include such external parasites as fleas and ticks, and such internal parasites as ascarids, hookworms, whipworms, heartworms and tapeworms. Both of the dog ascarids, Toxascaris and Toxocara, are present and often ascarids cause the deaths of pups. Hookworms are common and often cause severe hookworm disease and death. Whipworms are very common. Heartworms appear to be decreasing in Honolulu and on Maui, and possibly in other areas, as a result of mosquito control by drainage and the use of the top minnow, Gambusia. The tapeworms are usually a species of Dipylidium. There are known methods of treatment and prophylaxis for all of these parasites.

Parasites of sheep and goats. The writer had no opportunity to examine any sheep or goats, but was told that grub-in-the-head, Oestrus ovis, was present in sheep.

Parasites of cattle. Liver flukes, Fasciola hepatica, constitute the most important of the parasites of cattle in the islands. These flukes have been made the subject of a special report elsewhere.

A skin disease caused by a filarid worm was found at Honolulu and Hilo, with the worm present in the lesions at Hilo. The disease is identical with one discovered recently on the mainland, and probably has the same worm, Stephanofilaria stilesi, as its cause. The lesions are quite typical, consisting of areas in the midventral line, which originate as roughened areas and go on to a hairless condition with a thickened and indurated skin, usually smooth but sometimes somewhat cracked.

On the mainland one skinner in a packing house at Kansas City reported to the writer that he had seen the condition about 6 years ago. A foreman at a plant in San Francisco said he had seen it in Alberta, Canada, about 25 years ago. On the island of Hawaii a stockman told the writer that he had seen it about 14 years ago. The finding of the condition in Hawaii inclines the writer to believe that probably the parasite originated in the Orient, and that it will be found in the Philippines, China, Japan, probably in the carabao. Carabao were imported into Hawaii years ago, and there are now some wild and some still under domestication in the islands. The fact that the only other species of the genus Stephanofilaria, S. dedoesi, was found first in the Dutch East Indies and subsequently in India points very strongly to the likelihood that this genus is Asiatic.

On the island of Kauai a rumen fluke, not yet identified, was found in one animal.

The ox warble situation in Hawaii is of special interest. Apparently this parasite was imported for about a century before it became established. It is now well established on the island of Hawaii. A striking feature of the infestation is the fact that it has no such seasonal limitations as it has on the mainland. Statistics furnished by Dr. Bilikam, the Federal inspector in charge of meat inspection at Honolulu, show that for a period of 20 months the parasite was present every month of the year, with 10 per cent as the lowest monthly figure and 55 per cent as the highest.

As a sidelight on this, it might be noted that ox warbles shipped from the Northern Hemisphere to the Southern Hemisphere have so far failed to become established, presumably because there is a reversal of the winter and summer conditions which defeats the warble. Apparently the strain of warble which has developed in

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The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every entry must be supported by a valid receipt or invoice. This ensures transparency and allows for easy verification of the data.

In the second section, the author outlines the procedures for handling discrepancies. It states that any difference between the recorded amount and the actual amount must be investigated immediately. The steps for identifying the source of the error and correcting it are clearly defined.

The third part of the document provides a detailed explanation of the accounting cycle. It lists the eight steps involved in the process, from identifying the transaction to preparing the financial statements. Each step is accompanied by a brief description of its purpose and the required documentation.

The fourth section discusses the role of the accounting department in the overall business operations. It highlights how accurate financial data is essential for making informed decisions. The text also mentions the importance of regular communication between the accounting team and other departments.

The final part of the document contains a summary of the key points discussed. It reiterates the importance of accuracy, transparency, and communication in the accounting process. The author concludes by expressing confidence in the team's ability to maintain high standards of financial reporting.

Overall, the document serves as a comprehensive guide for anyone involved in the accounting process. It provides clear instructions and emphasizes the importance of following established procedures to ensure the integrity of the financial data.

Hawaii could be shipped to South America with considerable likelihood that it would become established. However, this possibility is conditioned by the possibility that the Hawaiian strain is actually developing $1\frac{1}{2}$ or 2 broods a year, and that a parasite now on such a cycle of development might find itself in difficulties if transported to any country in which there is a definite set-up of warm summers and cold winters.

Parasites of horses. While the writer had no opportunity for post-mortem examination of horses, his information is to the effect that bots, ascarids and strongyles, including Strongylus vulgaris as a cause of aneurism, are present. The presence of bots he can confirm from first-hand observation of numerous bot-fly eggs on horses' legs. Under the conditions afforded by the islands, campaigns for the eradication of bots by treatment could be carried out very easily and would, undoubtedly, result in marked benefit here as elsewhere. If eradication is ever accomplished, the bringing in of horses by importation, for the Army or for polo, would require appropriate measures to prevent the reimportation of bots.

Parasites of man. One of the interesting things found by the writer was a number of records of the sheep and cattle liver fluke, Fasciola hepatica, in man. At Hilo he was shown by Miss M. E. Campbell a specimen 43 mm. long taken at operation from the gall bladder of a 10-year old boy; one physician stated that the boy had had a subsequent operation and that a second fluke was found and removed.

Dr. L. L. Sexton of Hilo stated that he had found small flukes, the size of the nail of the little finger, in the body cavity at operation in 4 cases in the course of 25 years. This suggests to the writer that whereas young flukes entering the body cavity of quadrupeds will probably come in contact with the liver, flukes in the body cavity of bipeds, with their erect posture, may have difficulty in reaching the liver, since they might easily remain in the pelvic region by day and have difficulty traversing the route over intestines to the liver during the time the body is recumbent in sleep. Under such conditions the worms might never grow very large from failure to reach the normal site in the liver, and might often be overlooked.

Finally the writer was informed of 3 cases of human fascioliasis, diagnosed as such on Oahu. We have then a total of 8 cases reported to the writer in the brief time he could give to this subject. In view of the habit of eating water cress from streams polluted by cattle manure, it is probable that there have been hundreds of cases of human fascioliasis in the islands during the past 50 years. At the present time, strict regulation of the marketing of water cress should be inaugurated, and the public educated not to eat cress from dangerous areas.

A specimen sent to the Bureau of Animal Industry in 1905, is reported as sneezed from the nose, suggesting that "halzoun" from eating raw liver may have occurred occasionally in Hawaii.

At Hilo, specimens of Trichostrongylus sp. from man were given to the writer by Miss M. E. Campbell, and on examination by Dr. G. Dikmans this appears to be T. colubriformis, a species previously reported from man elsewhere. On Maui, Mrs. Powers has found some cases of the eggs of a Trichostrongylus every year for 3 years, but no specimens have been collected. This parasite deserves investigation. T. colubriformis is usually a parasite of sheep and occasionally a parasite of cattle. In the islands, which have a very small and highly localized sheep population and a large and widely distributed cattle population, it seems probable that human infestation usually follows from drinking water from streams contaminated with cattle manure.

Hookworm infestation, usually with Necator americanus and rarely with Ancylostoma duodenale, according to laboratory technicians, is fairly common over the

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Hawaiian islands, but is usually subclinical. However, some of the records seen covered relatively heavy infestations and there can be no doubt as to the occurrence of some cases of clinical infestations. The existing incidence points definitely to soil pollution, and there is a certain amount about dwellings and in the fields. Regardless of the extent of clinical ancylostomiasis, it is highly desirable that parasites as dangerous, actual or potentially, as hookworms should be eradicated. Additional sanitation provisions in the form of privies of a suitable type distributed over fields in regular use by laborers would be of value in hookworm control, and the practice of treating all cases, clinical or carrier, should be carried on and extended. Eradication of parasites must be regarded as a definite and worth-while goal of much more value and much sounder than the carrying on of the endless guerilla warfare against parasites. One cannot be too sure that some change in conditions influencing parasites in Hawaii will not make conditions favorable for an extension of hookworm infestation, and now is always the best time for eradication whenever the weapons and personnel for eradication are adequate, as they are in the islands.

According to reports of clinicians, whipworms are very prevalent in the islands. There is an indicated correlation between this high incidence of whipworms and a high incidence of appendicitis. Whether this indicated correlation is valid or not is something which might well receive investigation.

Pinworms are present in the islands but owing to the fact that fecal examinations do not disclose the incidence and pick-up cases only more or less accidentally, the actual incidence is not known. The development of an adequate drug for the removal of pinworms calls for a prolonged research of a suitable type and despite the numerous claims for various drugs there is not in the literature any work backed up by adequate protocols and evidence showing that we have established any such drug. A rigorous program of sanitary procedures is essential to pinworm control.

Ascarids in man are present on the various islands, but the incidence, like that of various other parasites, cannot be stated in precise terms since the available statistics were not seen by me in any summarized form and are, perhaps, not at present available in such form.

The tapeworms of man in the islands include Taenia saginata and Hymenolepis nana. Apparently the latter is the common tapeworm in the islands as it is in the United States.

Amebiasis, both in clinical and subclinical forms, occurs in the islands.

So far as could be ascertained, malaria is absent from the islands although its mosquito hosts are said to be present. Filariasis, from infestations with Wuchereria bancrofti, also appears to be absent although mosquitoes capable of transmitting it are present.

SUMMARY

A survey of parasites of man and domesticated animals in the Hawaiian Islands shows that there are a number of important parasites present, some of which are receiving routine attention. No parasite, with the exception of the sheep and cattle liver fluke, which is not the object of a control program, is being attacked over a wide front in a concerted and organized drive for eradication. Several parasites could be made the objects of eradication campaigns with some assurance that the objective could be gained.

Many conditions in the islands are highly favorable to success in control campaigns. Among these are the limited soil areas favorable for parasite development, the localization of areas having rainfall in such amounts as are favorable to parasitism, the relatively high economic level of the islands, the amount of control over the situation exercised by a relatively small, educated and intelligent group of owners and managers of estates, plantations, and ranges, the presence of a capable medical and veterinary force, a relatively large supply of hospitals, and the special conditions arising from an island set-up in which eradication is confined to small areas and its procedures backed up by easily imposed and effective quarantines possible for an island.

Any eradication campaigns require the presence of at least one well-trained parasitologist, and preferably more than one. Similarly, parasitologists are desirable to assist in detecting and controlling parasites which will be introduced into the islands from time to time and which can be best controlled before they become widely distributed and more or less out of hand except for large-scale control measures. This is desirable to protect human health, ensure efficient labor, and protect investments in livestock. There is at present more or less introduction of additions to the fauna of the islands, including the importation from Japan of snails which may some day become troublesome as carriers of various flukes parasitic in man and domesticated animals. It is very desirable to have a consulting parasitologist to cooperate with the University of Hawaii, the Territorial Board of Health, and the Territorial Veterinarian's Office in an advisory capacity as regards the advisability of importing new animals into the islands so far as their bearing on parasites is concerned.

It is impossible to acknowledge specifically the tireless cooperation and friendly assistance given me by all the persons with whom I came in contact during the month spent in the survey of parasite conditions in the islands. The staffs of the University, the Territorial Veterinarian's Office, the Territorial Board of Health, the owners and managers of plantations and ranges, dairymen, poultrymen, practising veterinarians and physicians, technicians and others were endlessly helpful, and the survey could not have covered the wide territory involved in the very limited time involved without this assistance. To all of these groups and others, I extend my hearty thanks.

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